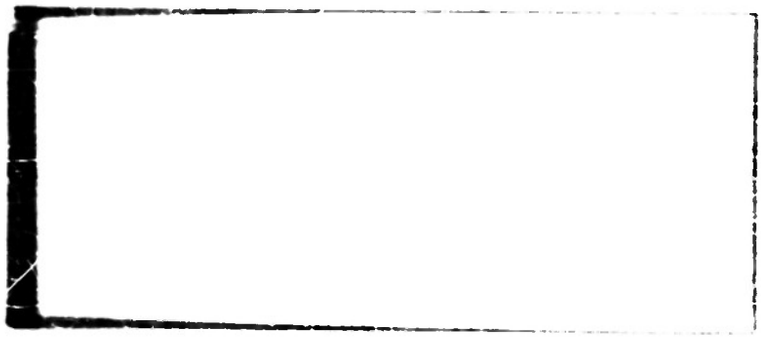
General Mills, Inc.

Mechanical Division



ENGINEERING RESEARCH & DEVELOPMENT DEPARTMENT

2003 EAST HENNEPIN AVENUE
MINNEAPOLIS 13, MINN.

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GENERAL MILLS, INC.
Engineering Research & Development Department
Mechanical Division
Minneapolis, Minn.

FINAL REPORT

PROJECT 85017

DATE 17 SEPTEMBER 1953

REPORT NO.: 1228

PREPARED BY: Keith C. Giles
Keith C. Giles

APPROVED BY: J. R. Smith
J. R. Smith
Balloon and Meteorological
Systems Group

I. INTRODUCTION

On 1 October 1952, Contract Nonr-875(00) between General Mills, Inc. and the Office of Naval Research was amended to provide for the execution of an experiment designed to carry scientific payloads to high altitudes. Payloads were supplied by the Armour Research Foundation, Chicago, Illinois. General Mills, Inc. supplied "Skyhook" balloons to carry aloft the payload instruments, balloon controls, recording and safety equipment. The flights were launched by General Mills technical personnel.

II. PROJECT PROGRAM

A traditional "Skyhook" balloon flight program was outlined for this project. One flight, #915, was flown from the University of Minnesota Airport, New Brighton, Minnesota. This flight was tracked and recovered by General Mills, Inc. technical personnel in a Stinson aircraft.

The remaining flights were launched from the Naval Air Station at Waldron, Texas.

Except as noted below, the equipment included in each flight consisted of the following:

1. A polyethylene balloon 85 feet in diameter and one mil thick.

2. A 28 foot parachute on which the scientific payload and balloon instruments descended to earth after being released from the balloon.

3. A timer set to release the load from the balloon at a predetermined time when the scientific experiment was concluded.

4. A safety device required by the C.A.A., consisting of a pressure switch set to prevent the balloon from floating below 30,000 ft.

5. Scientific payload provided by Armour Research Foundation, Chicago, Illinois.

6. A radio transmitter whose frequency is modulated by a pressure sensor.

7. A barograph to record the altitude reached.

8. Two 5-gallon tins to act as floats for a water impact.

Helium for inflation was provided by the Navy. Inflation was carried out with the use of a platform to keep the "bubble" taut in the early stages.

The exceptions to the above equipment list is as follows:

1. The flight from New Brighton, Minnesota, used a 24 foot parachute, carried no float tins and used a radio-controlled release. Two control stations were activated, one transmitter, 100 watts, was located at the General Mills Laboratory at Minneapolis; the other transmitter, 40 watts, was carried in the General Mills tracking aircraft. The release was accomplished from the aircraft.

2. The first two flights from Texas, flights 941 and 942, and the last two flights from Texas, flights 949 and 950, carried no float tins. In addition, flight 950 used a 24 foot parachute.

A total of 11 flights were made under this project. The flight performance data are presented in the next section of this report.

One flight, 941, gave inaccurate pressure-height data, as checked with a theodolite, and another, 943, was torn in launching and lost equipment. The remaining 9 flights were all successful in balloon operation, the accessory balloon equipment showing excellent results and providing the

desired services. It is hoped that the scientific payload performed satisfactorily and that the entire operation met with success. General Mills, Inc. is happy to have had the opportunity of working with the Office of Naval Research and the Armour Research Foundation in carrying out these experiments.

Mechanical Division
Engineering Research and Development Department
Minneapolis, Minnesota

FLIGHT SUMMARY

Flight No.: 915 Balloon Serial No.: 504

Date: 16 October 1952 Launching Time: 0810 Type: 851A Weight: 148#

Who: 8-5017 Armour Research Foundation

What; Armour Gondola

Duration: 3 3/4 hrs. to release by radio control. Load on Balloon: 122#

Gross Load: 270# Free Lift: 35# 13.3%

Maximum Altitude: 98,900 ft. Rate of Rise: 611 ft/min to 70,000 ft.

Theoretical Altitude: 101,800 Altitude Maintenance: Excellent

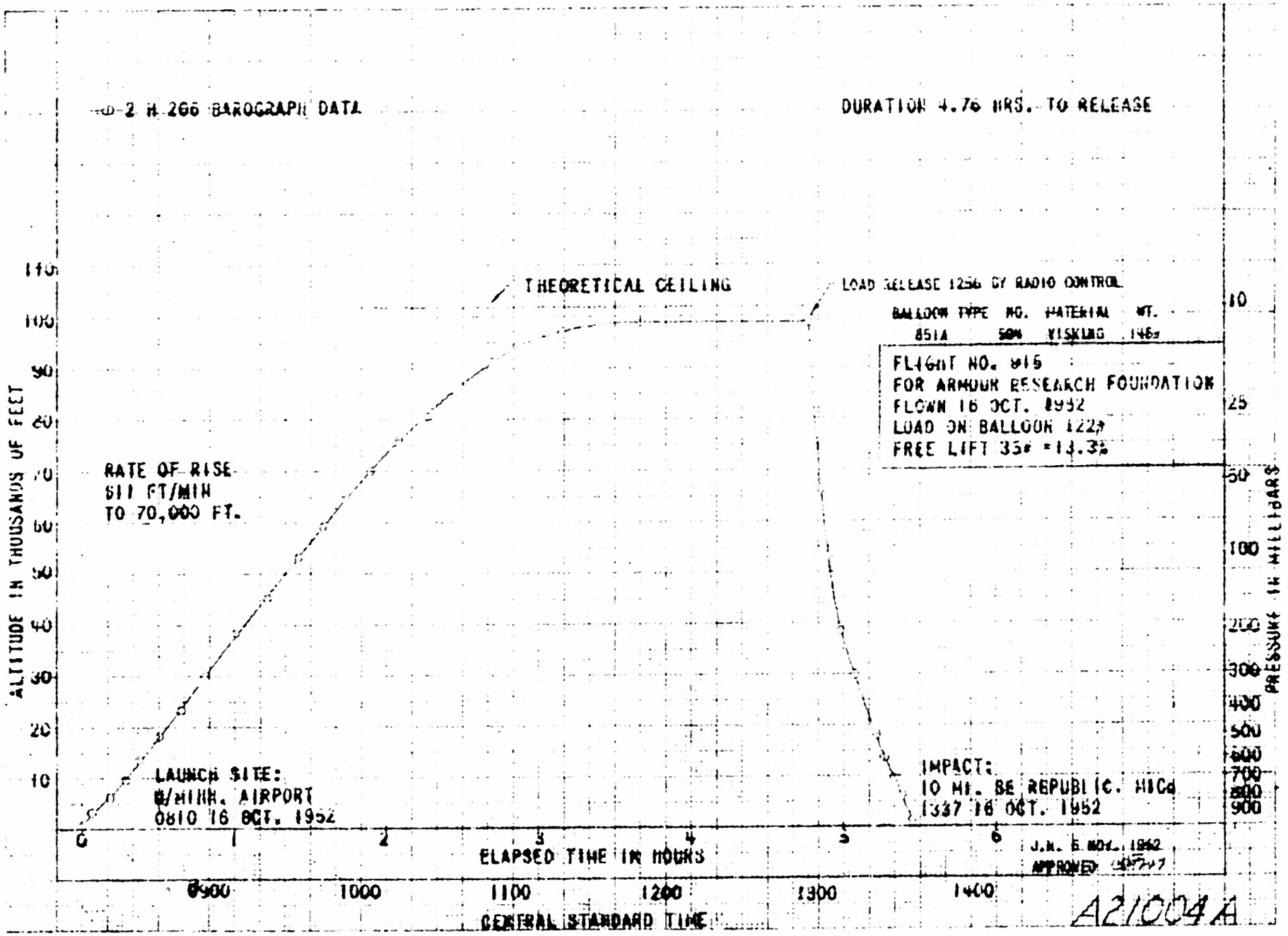
Recovery: where? 10 Mi. SE Republic, Michigan when? Immediate

Balloon Success: Good

Critique: Air picked up by cell due to too slow a rate of rise and levelled off below theoretical ceiling. Load released by Church's radio release at Lake Superior's shore.

Scientific Purpose: Flight Check of Telemetered Scintillation Counter Data

Scientific Success as known: Good



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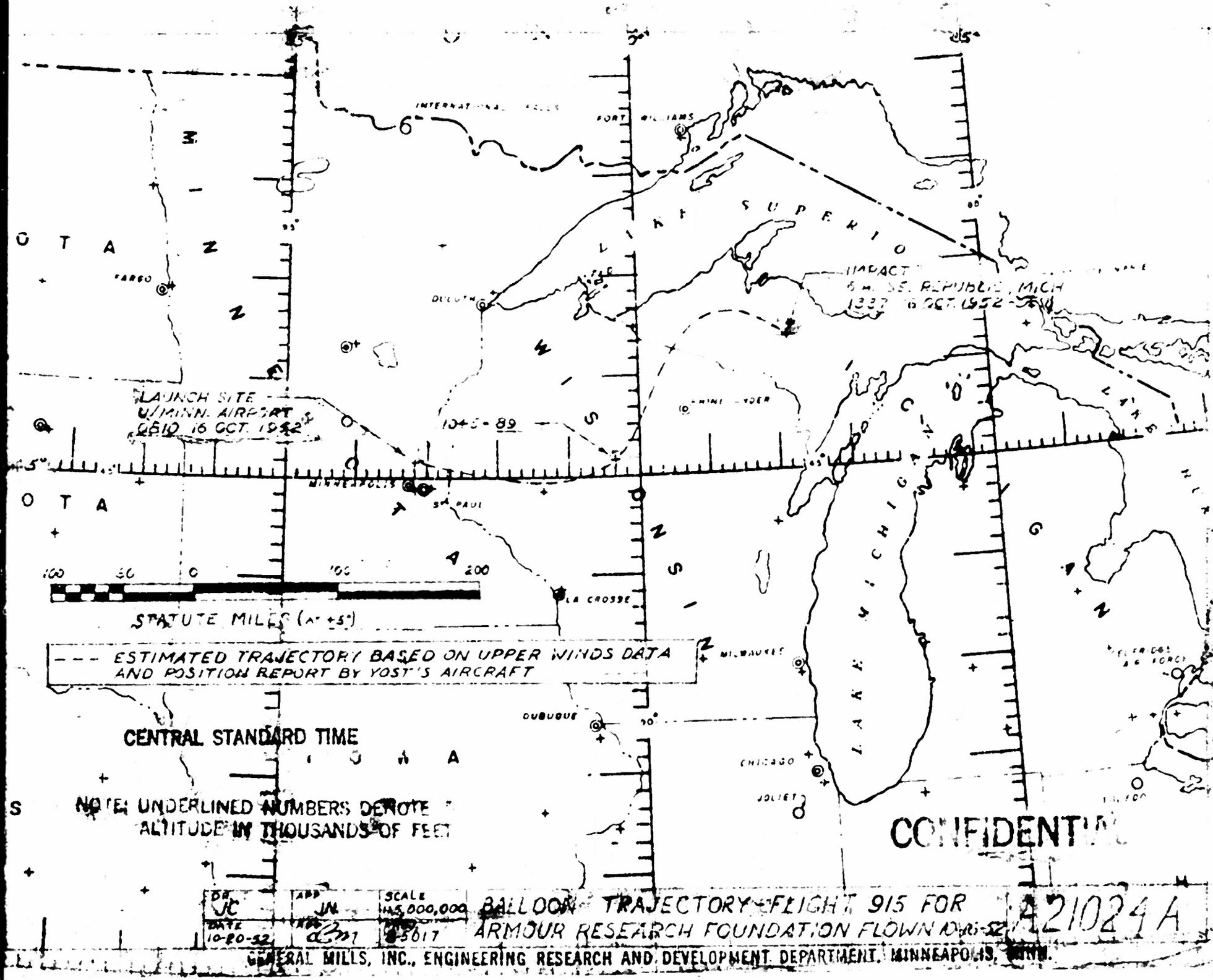
LAUNCH SITE
U/MINN. AIRPORT
0810 16 OCT. 1952
IMPACT
6 MI. S.E. REPUBLIC, MICH
1337 16 OCT. 1952
1043 - 89
FARGO
DULUTH
MINNEAPOLIS
ST. PAUL
LA CROSSE
DUBUQUE
CHICAGO
JOLIET
MILWAUKEE
LAKE MICHIGAN
LAKE SUPERIOR
INTERNATIONAL FALLS
FORT WILLIAMS
100 50 0 100 200
STATUTE MILES (AT +5°)
--- ESTIMATED TRAJECTORY BASED ON UPPER WINDS DATA AND POSITION REPORT BY YOST'S AIRCRAFT
CENTRAL STANDARD TIME
NOTE: UNDERLINED NUMBERS DENOTE ALTITUDE IN THOUSANDS OF FEET
CONFIDENTIAL
DR JC
CHD JN
SCALE 1:5,000,000
DATE 10-20-52
5017
BALLOON TRAJECTORY FLIGHT 915 FOR ARMOUR RESEARCH FOUNDATION FLOWN 10-16-52
421024A
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Minneapolis, Minn.

FLIGHT SUMMARY

Flight No.: 941 Balloon Serial No.: 417

Date: 2 November 1952 Launching Time: 0846C Type: 851A Weight: 163#

Who: 8-5017 - Armour Research Foundation

What: Armour Gondola Load on Balloon: 113#

Duration: Scheduled - 4.5 hrs. from 0820; Actual - 3.9 hrs.

Gross Load: 276# Free Lift: 48# 17%

Maximum Altitude: 95,000 estimated Rate of Rise: 1068 ft/min to 68,350 ft.

Theoretical Altitude: 101,600 ft. Altitude Maintenance: Good

Recovery: where? none, impact at sea

Balloon success: Good

Critique: High rate of rise, did not reach theoretical ceiling by telemetering though double theodolite readings indicate it.

Scientific Purpose: Flight Check of Telemetered Scintillation Counter Data

Scientific Success as known: Incorrect Altitude information made calibration impossible.

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FLIGHT SUMMARY

Flight No.: 942 Balloon Serial No.: 401

Date: 3 November 1952 Launching Time: 0630C Type: 851A * Weight: 126#

Who: 8-5017 Armour Research Foundation

What: Armour Gondola

Duration: Sched. 8 hrs. from 0630
Actual Unknown

Load on Balloon: 113#

Gross Load: 239#

Free Lift: 37# 15#

Maximum Altitude: 95,100

Rate of Rise: 1012 ft/min to 94,100 ft.

Theoretical Altitude: 104,600

Altitude Maintenance: Good

Recovery: where? None

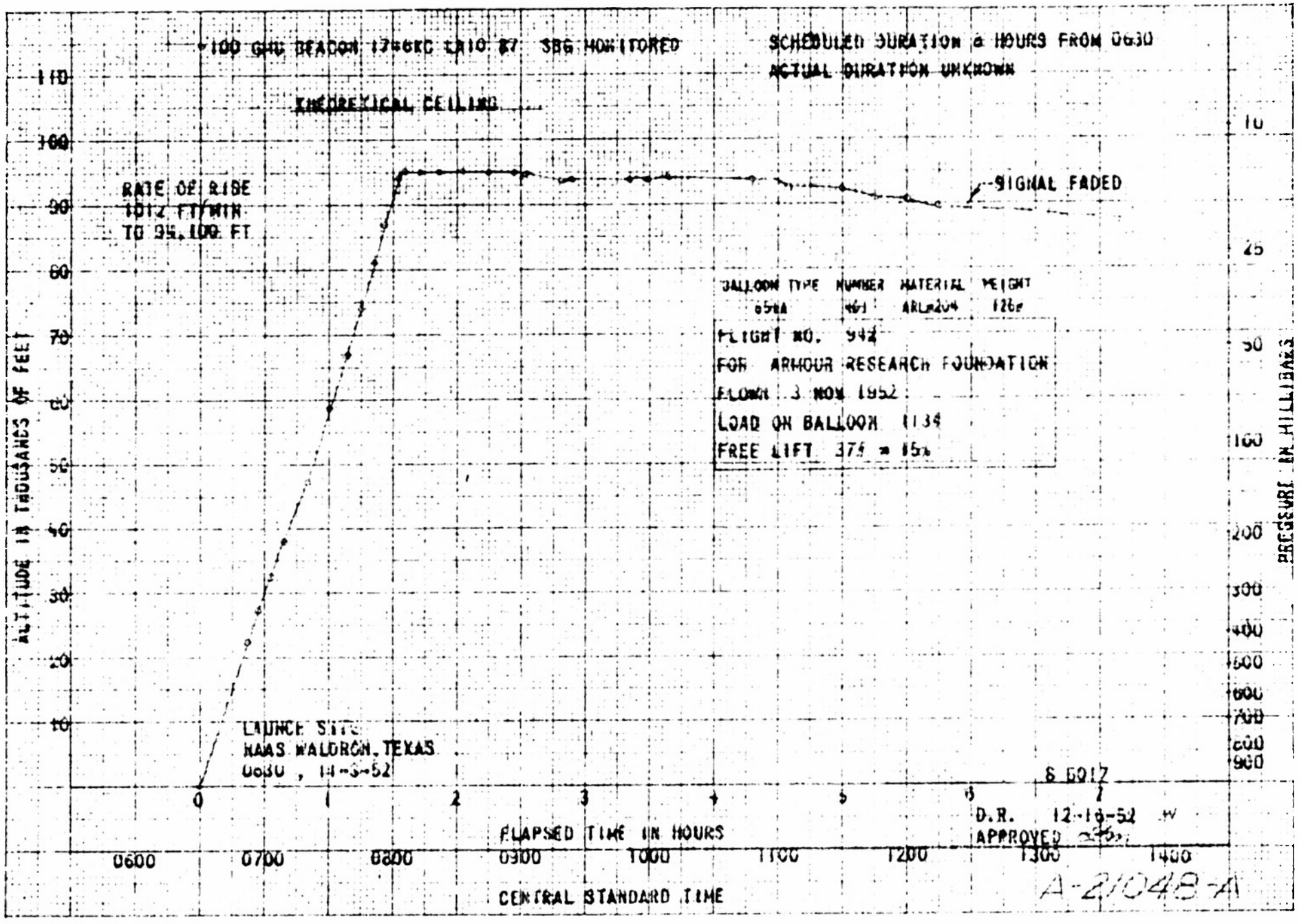
Balloon Success: Excellent

Critique: High initial rate of rise and flight did not reach theoretical ceiling. Maximum timer setting did not produce recovery as anticipated. Scintillation telemetering (6425KC) faded before altitude telemetering (1746KC) faded indicating flight proceeded beyond skip distance.

*.0005 wall balloon.

Scientific Purpose:
Flight Check of Telemetered Scintillation Counter Data.

Scientific Success as known: Good



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FLIGHT SUMMARY

Flight No.: 944 Balloon Serial No.: 412

Date: 11-3-52 Launching Time: 0649C Type: 851A Weight: 161#

Who: 8-5017 Armour Research Foundation

What: Armour Gondola

Duration: Sched. 4 hrs. from 0617
Actual 3.7 hrs. Load on Balloon: 118#

Gross Load: 278 Free Lift: 34# 12%

Maximum Altitude: 99,200 Rate of Rise: 593 ft/min to 45,250 ft.
707 ft/min to 92,200 ft.

Theoretical Altitude: 101,400 Altitude Maintenance: Good

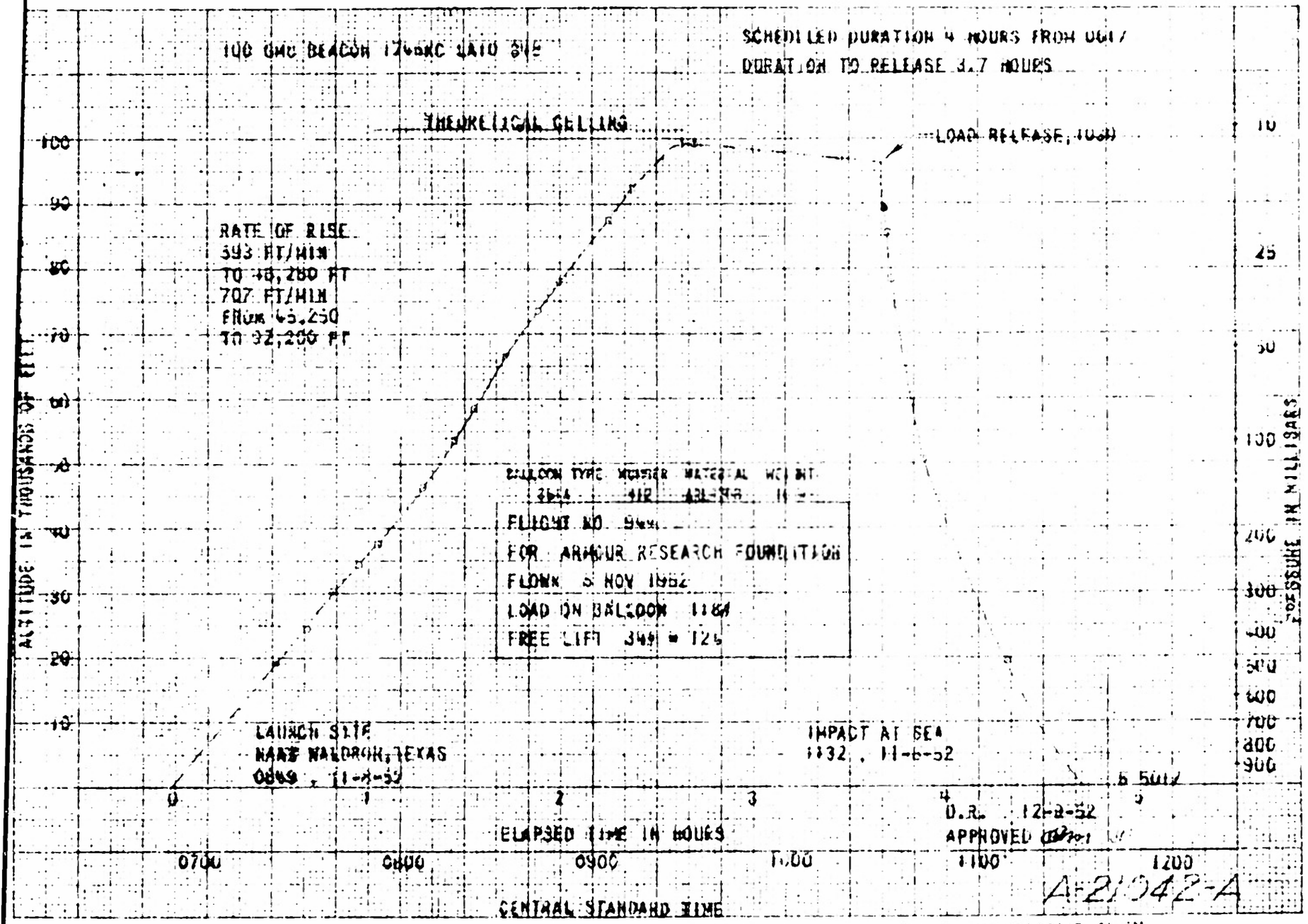
Recovery: Where? None - impact at sea.

Balloon Success: Good

Critique: Cell picked up air on ascent with slow rate of rise due to probable gas measurement error. Telemetering poor due to operation of second SBG in vicinity.

Scientific Purpose:
Flight Check of Telemetered Scintillation Counter Data.

Scientific Success as known: Negative



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FLIGHT SUMMARY

Flight No.: 945 Balloon Serial No.: 414

Date: 11-11-52 Launching Time: 0651.6 Type: 851A Weight: 160 1/2

Who: 8-5017 Armour Research Fountation

What: Armour Gondola

Duration: Sched. 4 hrs. from 0645
Actual 3.7 hrs. from 0651.6 Load on Balloon: 119#

Gross Load: 279# Free Lift: 35# 12 1/2%

Maximum Altitude: 95,100 Rate of Rise: 991 ft/min to 93,900 ft.

Theoretical Altitude: 101,200 Altitude Maintenance: Excellent

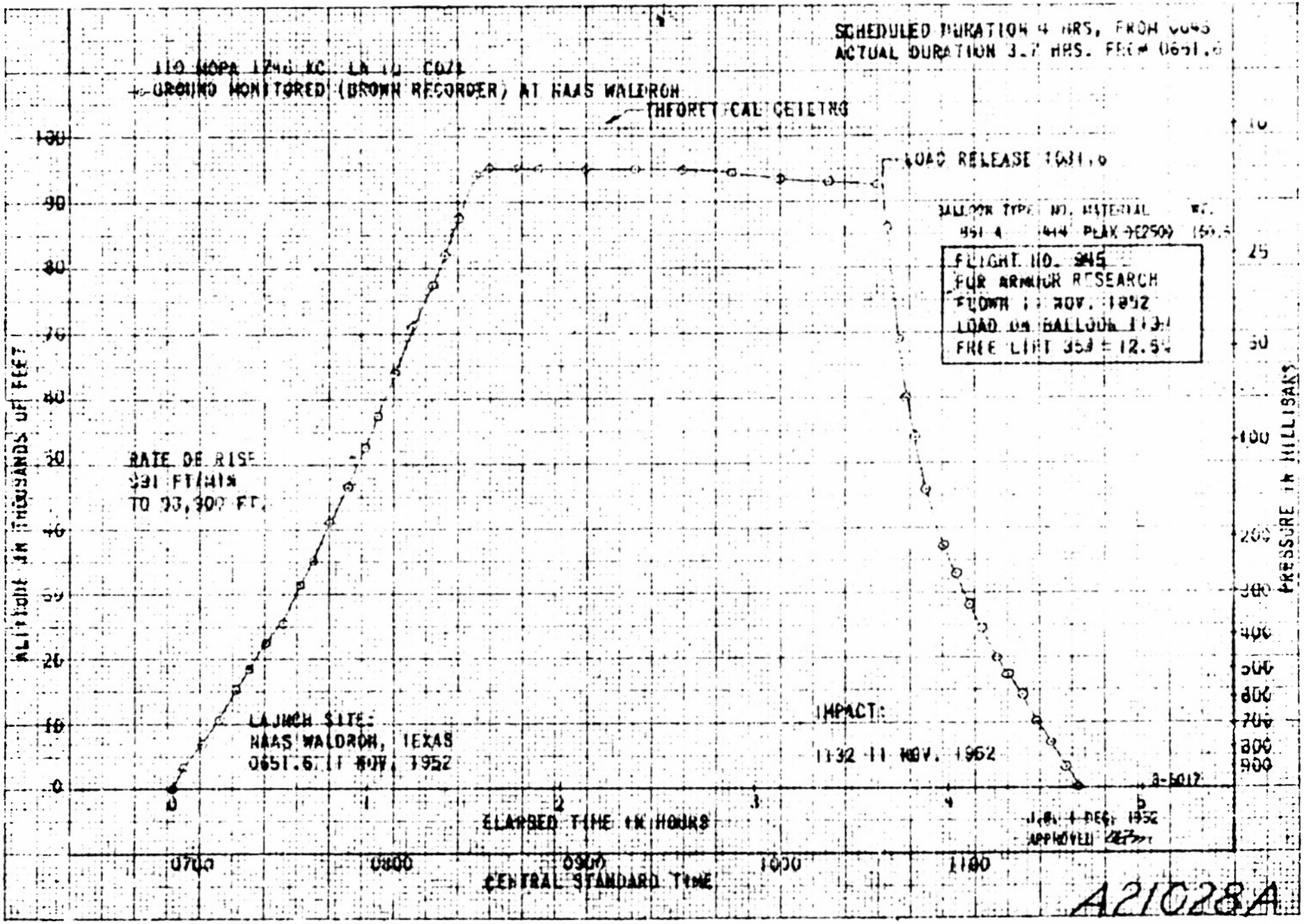
Recovery: where? impact in sea

Balloon Success: Good

Critique: Rate of rise high and theoretical ceiling missed by 7,000 ft.

Scientific Purpose:
Flight Check of Telemetered Scintillation Counter Data.

Scientific Success as known: Negative



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FLIGHT SUMMARY

Flight No.: 946 Balloon Serial No.: 513

Date: 14 November 1952 Launching Time: 0816.8C Type: 851A Weight: 144#

Who: 8-5017 Armour Research Foundation

What: Armour Gondola

Duration: Sched. 3 hrs. from 0815
Actual 2.9 hrs. Load on Balloon: 126#

Gross Load: 270# Free Lift: 45# 17%

Maximum Altitude: 102,000 Rate of Rise: 1053 ft/min to 96,000 ft.

Theoretical Altitude: 101,900 Altitude Maintenance: Good

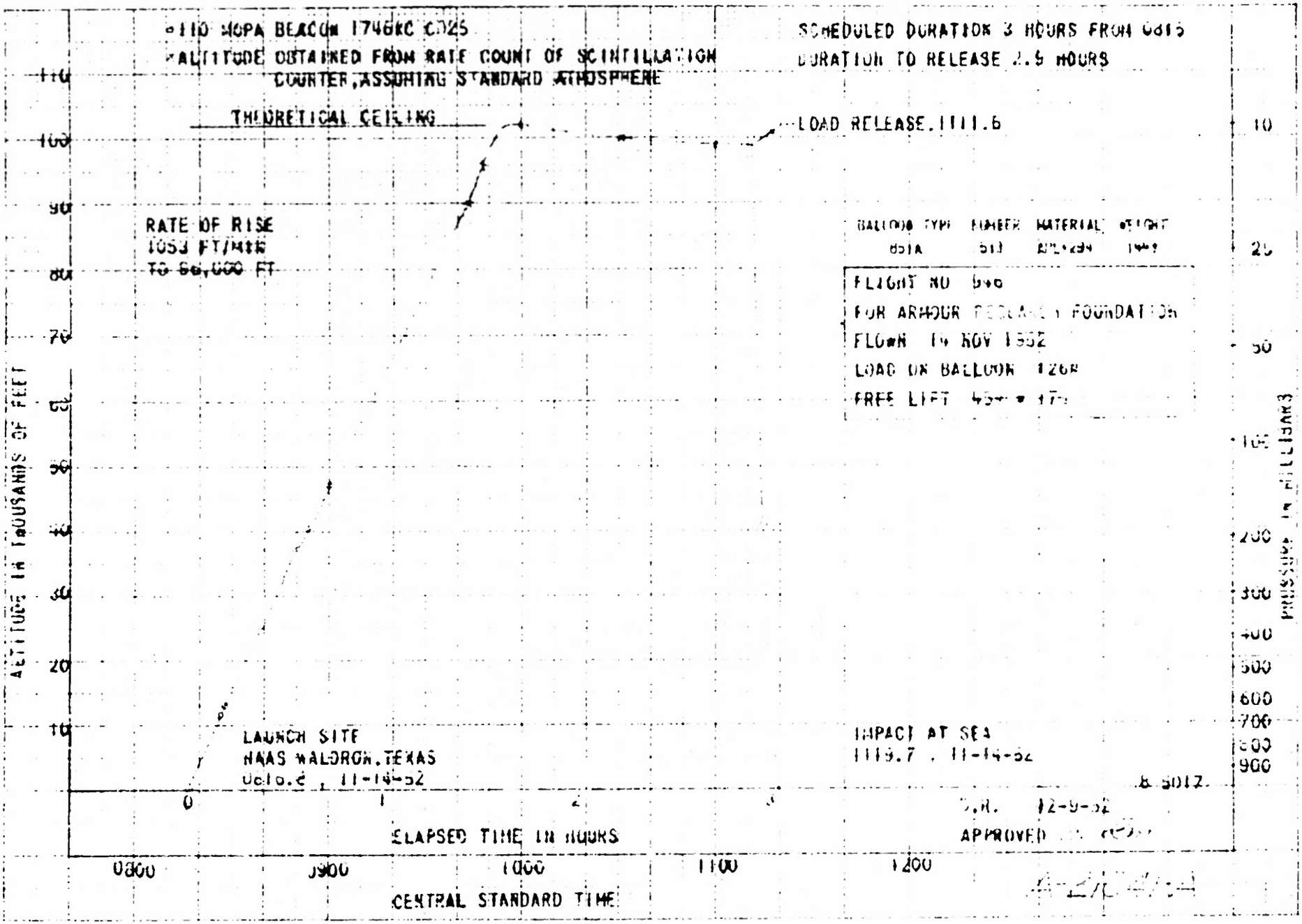
Recovery: where? None - impact at sea

Balloon Success: Excellent

Critique: High initial rate of rise. Beacon apparently free fell as 6425 KC signal very weak and 1746 KC went out 8.1 minutes after release.

Scientific Purpose: Flight Check of Telemetered Scintillation Counter Data

Scientific Success as Known: Negative


*110 MOPA BEACON 1746KC C045
*ALTITUDE OBTAINED FROM RATE COUNT OF SCINTILLATION COUNTER, ASSUMING STANDARD ATMOSPHERE
SCHEDULED DURATION 3 HOURS FROM 0615
DURATION TO RELEASE 2.5 HOURS
THEORETICAL CEILING
LOAD RELEASE 1111.6
RATE OF RISE
1053 FT/MIN
TO 66,000 FT
BALLOON TYPE NUMBER MATERIAL WEIGHT
MOTA 511 NEOPRENE 1447
FLIGHT NO 640
FOR ARMOUR RESEARCH FOUNDATION
FLOWN 14 NOV 1952
LOAD ON BALLOON 1268
FREE LIFT 450 ± 17
ALTITUDE IN THOUSANDS OF FEET
PRESSURE IN MILLIBARS
LAUNCH SITE
NAAS WALDRON, TEXAS
0615.6 , 11-14-52
IMPACT AT SEA
1119.7 , 11-14-52
& 5012.
J.R. 12-9-52
APPROVED
ELAPSED TIME IN HOURS
0800
0900
1000
1100
1200
CENTRAL STANDARD TIME
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Mechanical Division
Engineering Research and Development Department
Minneapolis, Minnesota

FLIGHT SUMMARY

Flight No.: 947 Balloon Serial No.: 514

Date: 11-19-52 Launching Time: 0659.4C Type: 851A Weight: 148

Who: 8-5012 Armour Research Foundation

What: Armour Gondola

Duration: Sched. 8 hrs. from 0653
Actual 7.7 hrs. Load on Balloon: 114#

Gross Load: 261# Free Lift: 34# 13%

Maximum Altitude: 98,000 Rate of Rise: 927 ft/min to 82,500

Theoretical Altitude: 102,800 Altitude Maintenance: Fair

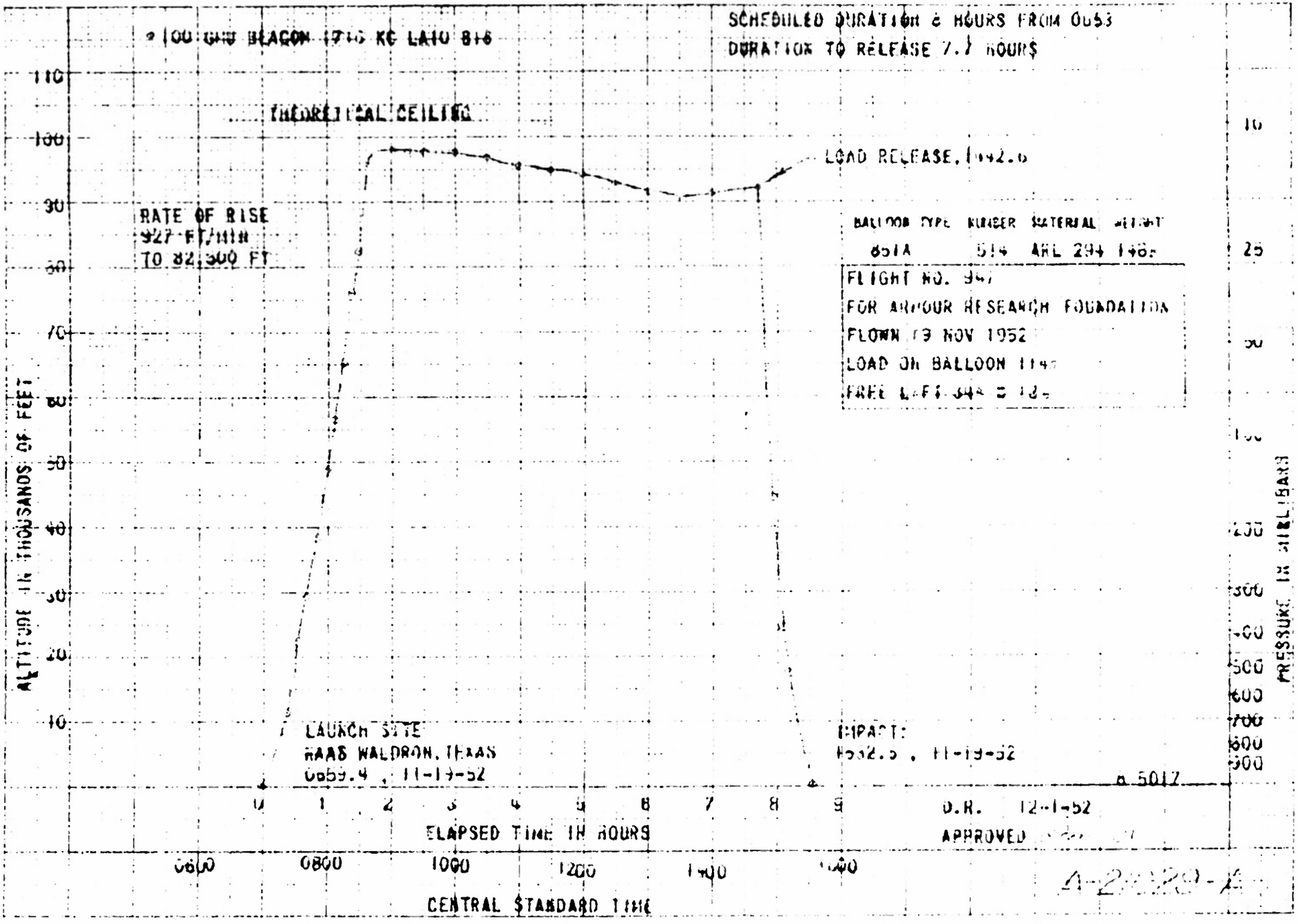
Recovery: where? None - impact at sea

Balloon Success: Good

Critique: High rate of rise and failed to reach theoretical ceiling by 5,000 ft. Longer duration employed in endeavor to recover instruments.

Scientific Purpose:
Flight Check of Telemetered Scintillation Counter Data

Scientific Success as known: Negative



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M

Flight No.: 943

Date: 11-22-52 Launching Ti

Who: 6-5017 Armour Institute

What: Armour Gondola, Beacon

Duration: Sched. 3.5 from 065
Actual 3.4 hrs.

Gross Load: 261#

Maximum Altitude: 93,500 ft.

Theoretical Altitude: 102,800 f

Recovery: where? None -- impa

Balloon Success: Questionable

Critique: Rate of rise high a
tied off loosely, th
launched believed r

Scientific Purpose: Flight Chec

Scientific Success as known: P

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FLIGHT SUMMARY

Flight No.: 949 Balloon Serial No.: 515

Date: 11-24-52 Launching Time: 0722C Type: 851- Weight: 145#

Who: 8-5012 Armour Research Foundation

What: Armour Gondola

Duration: Sched. 3.5 hrs. from 0720
Actual 3.4 hrs. Load on Balloon: 116#

Gross Load: 261# Free Lift: 37# 14#

Maximum Altitude: 94,850 Rate of Rise: 803 ft/min to 94,850 ft.

Theoretical Altitude: 102,800 Altitude Maintenance: Good

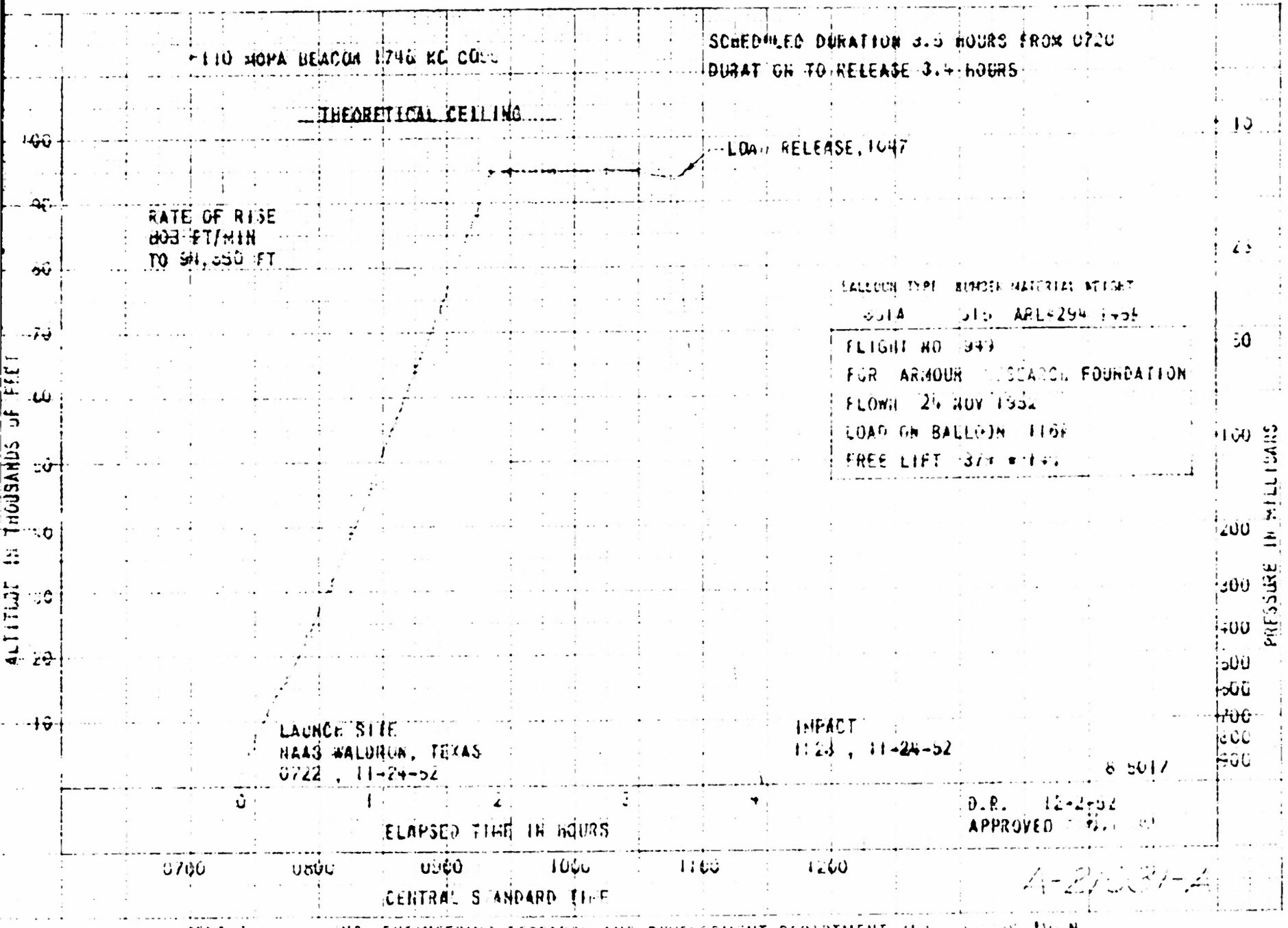
Recovery: where? None - impact at sea

Balloon Success: Good

Critique: Ceiling missed by 8,000 ft. Extra gas added to compensate for saturation of flight gear, nylonaand balloon in rain showers. Very fast launch. QB served wind at NAS Corpus 18K @ 0727C.

Scientific Purpose: Flight Check of Telemetered Scintillation Counter Data.

Scientific Success as known: Negative



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FLIGHT SUMMARY

Flight No.: 950 Balloon Serial No.: 517

Date: 11-30-52 Launching Time: 0822.5C Type: 851A Weight: 151#

Who: 8-5017 Armour Research Foundation

What: Armour Gondola

Duration: Sched. 3.5 hrs. from 0810
3.2 hrs. Load on Balloon: 107#

Gross Load: 258# Free Lift: 43# 17%

Maximum Altitude: 103,350 Rate of Rise: 890 ft/min to 101,400 ft.

Theoretical Altitude: 103,100 Altitude Maintenance: Excellent

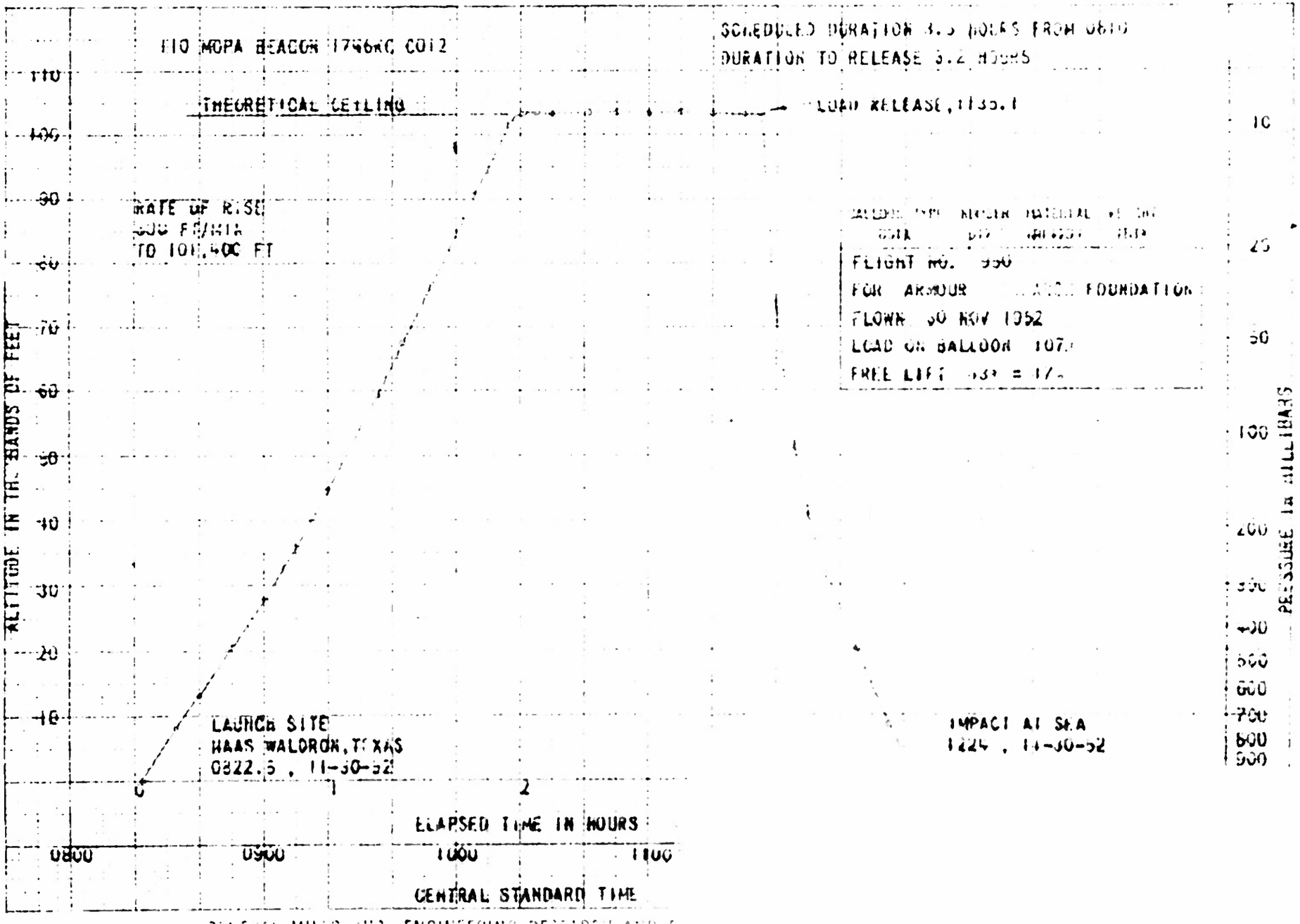
Recovery, where? None - impact at sea

Balloon Success: Excellent

Critique: Extra lift added to compensate for loss of gas through split inflation tube approximately 35' from appendix, and for rain and mud on flight gear.

Scientific Purpose: Flight Check of Telemetered Scintillation Counter Data

Scientific Success as Known: Counter malfunctioned.



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